

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims

Claims

What is claimed is:

1. (Currently amended) A homogenous process for the hydrogenation of dicarboxylic acids and/or derivatives thereof with an amine in the presence of a catalyst comprising:
 - (a) ruthenium or osmium; and
 - (b) an organic phosphine;and wherein the hydrogenation is carried out in the presence of water.
2. (Original) A homogenous process according to Claim 1 wherein the water is present in at least 1% by weight.
3. (Currently amended) A homogenous process according to Claim 1 ~~or 2~~ wherein the dicarboxylic acid and/or derivative thereof is selected from one or more of dicarboxylic acids, polycarboxylic acids, anhydrides, monoesters or diester of dicarboxylic acids, monoamides or diamides of dicarboxylic acids, salts, such as amine salts, of dicarboxylic acids or mixtures

4. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 3~~ Claim 1 wherein the dicarboxylic acid and/or derivative thereof is a C₄ to C₁₂ dicarboxylic acid.
5. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 4~~ Claim 1 wherein the dicarboxylic acid and/or derivative thereof is saturated or unsaturated.
6. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 5~~ Claim 1 wherein the dicarboxylic acid and/or derivative thereof is selected from maleic acid, fumaric acid, succinic acid, maleic anhydride, adipic acid, and succinic anhydride.
7. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 6~~ Claim 1 wherein the amine is NR¹R²R³ where R¹, R² and R³ are each ~~selected from~~ hydrogen or alkyl.
8. (Original) A homogenous process according to Claim 7 wherein the alkyl group is a C₁ to C₆ alkyl group.
9. (Original) A homogenous process according to Claim 8 wherein the alkyl group is methyl, ethyl or propyl.

10. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 9~~ Claim 1 wherein the amine is mixed with the dicarboxylic acid and/or derivatives thereof prior to undergoing the process.
11. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 10~~ Claim 1 wherein the dicarboxylic acid and/or derivative thereof is converted to the amide by reaction with the amine prior to commencement of the hydrogenation.
12. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 11~~ Claim 1 wherein the water is present as the solvent for the reaction.
13. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 11~~ Claim 1 wherein one or both of the reactants or the product of the reaction are the solvent.
14. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 13~~ Claim 1 wherein a solvent is used and water is present as an additive in the solvent.

15. (Original) A homogenous process according to Claim 14 wherein the solvent is selected from tetraethyleneglycol dimethyl ether, N-methyl pyrrolidone, diethyl ether, ethyleneglycol dimethylether, dioxane, 2-propanol, 2-butanol, secondary alcohols, tertiary alcohols, lactams and N-methyl caprolactam.
16. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 11~~ Claim 1 wherein the water is produced in situ as a by-product of the hydrogenation reaction.
17. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 16~~ Claim 1 wherein the catalyst comprises ruthenium and the ruthenium is provided as a ruthenium compound.
18. (Original) A homogenous process according to Claim 17 wherein the ruthenium compound is a compound selected from nitrates, sulphates, carboxylates, beta diketones, or carbonyls.
19. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 18~~ Claim 1 wherein the ruthenium is present in an amount of from 0.0001 to 5 mol, preferably 0.005 to 1 mol, as ruthenium per liter of reaction solution.

20. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 19~~ Claim 1 wherein the phosphine is a tridentate phosphine.
21. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 19~~ Claim 1 wherein the phosphine is selected from trialkylphosphines, dialkylphosphines, monoalkylphosphines, triarylphosphines, diarylphosphines, monoarylphosphines, diarylmonoalkyl phosphines and dialkylmonoaryl phosphines.
22. (Currently amended) A homogenous process according to Claim 21 wherein the phosphine is selected from tris-1,1,1-(diphenylphosphinomethyl)methane, tris-1,1,1-(diphenylphosphinomethyl)[[-]]ethane, tris-1,1,1-(diphenylphosphinomethyl)propane, tris-1,1,1-(diphenylphosphinomethyl)butane, tris-1,1,1-(diphenylphosphinomethyl)2,2-dimethylpropane, tris-1,3,5-(diphenylphosphino[[-]]methyl)cyclohexane, tris-1,1,1-(dicyclohexylphosphinomethyl)[[-]]ethane, tris-1,1,1-(dimethylphosphinomethyl)ethane, tris-1,1,1-(diethylphosphino[[-]]methyl)ethane, 1,5,9-triethyl-1,5,9-triphosphacyclododecane, 1,5,9-triphenyl-1,5,9-triphosphacyclododecane, bis(2-diphenylephosphinoethyl)phenylphosphine, bis-1,2-(diphenyl phosphino)ethane, bis-1,3-(diphenyl phosphino)propane, bis-1,4-(diphenyl phosphino)butane,

bis-1,2-(dimethyl phosphino)ethane,
bis-1,3-(diethyl phosphino)propane,
bis-1,4-(dicyclohexyl phosphino)butane,
tricyclohexylphosphine, trioctylphosphine,
trimethyl phosphine, tripyridyl phosphine and
triphenylphosphine.

23. (Original) A homogenous process according to Claim 21 wherein the phosphine is selected from tris-1,1,1-(diarylphosphinomethyl)alkane and tris-1,1,1-(dialkylphosphinomethyl)alkane.
24. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 23~~ Claim 1 wherein the catalyst is preformed.
25. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 24~~ Claim 1 wherein the phosphine compound is present in an amount of from 0.0001 to 5 mol as ~~phosphine~~ per liter of reaction solution.
26. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 25~~ Claim 1 wherein the hydrogenation is carried out at temperatures ~~in the region of~~ from about 190°C to about 300°C.
27. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 26~~ Claim 1 wherein the reaction pressure is from about 500 psig to about 2000 psig.

28. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 27~~ Claim 1 wherein the ratio of the amine to the dicarboxylic acid or derivative thereof is from about 0.5:1 to about 100:1.
29. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 28~~ Claim 1 wherein the ratio of the amine to the dicarboxylic acid or derivative thereof is from about 0.9:1 to about 2.0:1.
30. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 29~~ Claim 1 wherein the product is a 2-pyrrolidone or an N-alkylated version thereof and the dicarboxylic acid or derivative thereof is maleic acid, maleic anhydride, succinic acid or succinic anhydride.
31. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 29~~ Claim 1 wherein the product is caprolactam and the dicarboxylic acid or derivative thereof is adipic acid.
32. (Currently amended) A homogenous process according to ~~any one of Claims 1 to 31~~ Claim 1 wherein the catalyst is regenerated in the presence of the water and hydrogen.